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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Migration of a pre-standard network to a metro transport network

ITU-T G-series Recommendations – Supplement 69

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Supplement 69 to ITU-T G-series Recommendations

Migration of a pre-standard network to a metro transport network

Summary

Supplement 69 to ITU-T G-series Recommendations describes scenarios for migrating existing slicing packet networks (SPNs) to metro transport networks (MTNs). Scenarios include carrying SPN path layer connections over MTN section layers, or for carrying MTN path layer connections over SPN section layers. It also describes how misconfiguration of the end points that result in the connection of a SPN end point to a MTN end point can be detected.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Migration, MTN, SPN.

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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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Migration of a pre-standard network to a metro transport network

1 Scope

This Supplement describes considerations for migration of networks using pre-standard SPN to using metro transport network (MTN) technology.

2 References

[ITU-T G.805] Recommendation ITU-T G.805, *Generic functional architecture of transport networks*.

[ITU-T G.8312] Recommendation ITU-T G.8312 (2020), *Interfaces for the metro transport network.*

[IEEE 802.3] IEEE 802.3-2018, IEEE Standard for Ethernet

3 Definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 Terms defined in [IEEE 802.3]

– LF

– Ordered Set

– RF

3.1.2 Terms defined in [ITU-T G.805]

– Termination function

– Network

3.2 Terms defined in this Supplement

None.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

APS Auto Protection Switching

BIP Bit-Interleaved Parity

MTN Metro Transport Network

OAM Operations Administration and Maintenance

SPN Slicing Packet Network

5 Conventions

None.

6 Migration requirements

As a predecessor of the MTN technology, there exist substantial implementations and deployments of a pre-standard technology (known as slicing packet network, SPN). SPN is defined with a set of technologies from L0 to L3, and ITU-T G.8312 MTN corresponds to the SPN slicing channel layer. See [b-CCSA-2019-1213T-YD] in the Bibliography for a detailed description of SPN.

This Supplement provides information to help guide how an operator can gracefully migrate from a network of pre-standard nodes to one using ITU-T G.8312-compliant MTN nodes.

7 Migration scenarios

7.1 Pass-through migration mode

The pass-through migration mode takes advantage of MTN and pre-standard intermediate nodes being transparent to the path and path overhead of both protocols. Consequently, edge nodes that use the same protocol can communicate with each other through any intermediate nodes along the path. This is illustrated in Figure 7-1, where both the sink node and source node (the green colour) work in standard A (for example standard [ITU-T G.8312]), and the intermediate nodes (the gold colour) work in the different format (for example pre-standard SPN). This allows edge nodes to be upgraded independently from the intermediate network nodes. Clause 8 explains how an edge node can determine the protocol for which the other edge node is configured.

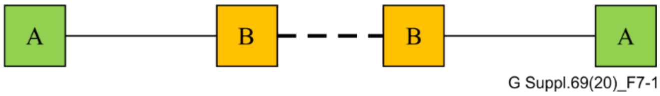

Figure 7-1 – Pass-through migration mode

7.2 Gateway node migration mode

During network migration or new network additions, some network domains will be built or migrated to MTN ahead of other network domains. This scenario is illustrated in Figure 7-2. In this situation, a network operator may choose to have a gateway node between the network domains. There are two general approaches for providing the gateway function.

For the first approach, the service is delivered over a serial concatenation of pre-standard paths and MTN paths (see Path 1a and Path 1b in Figure 7-2). The operations administration and maintenance (OAM) at the pre-standard path port and the MTN path port in the gateway node is fully terminated. Forwarding of the client information can either be done at the client layer (i.e., MAC frames) or at the 66B coding sublayer. End-to-end service monitoring of the serial concatenation of paths is possible via a tandem connection in the client layer at the service endpoints (e.g., between the two endpoints of Path 1 in Figure 7-2).

With the second approach, the gateway node provides a functional translation between the two protocols (see Path 2 in Figure 7-2). The Path 66B block sequence is passed between the pre-standard path and the MTN path ports, but the Path OAM blocks and corresponding messages are extracted, and then the functionally equivalent OAM blocks of the other protocol are inserted into the egress block sequence on the other side. The functional translation accounts for specific differences between SPN and MTN path overhead (e.g., the insertion rate and number of blocks covered by the bit-interleaved parity (BIP)-type error monitoring function and the insertion reference point for timestamp messages) that do not allow directly forwarding the same OAM messages between SPN and MTN Paths.

Detailed specification the gateway node functions is beyond the scope of this Supplement.

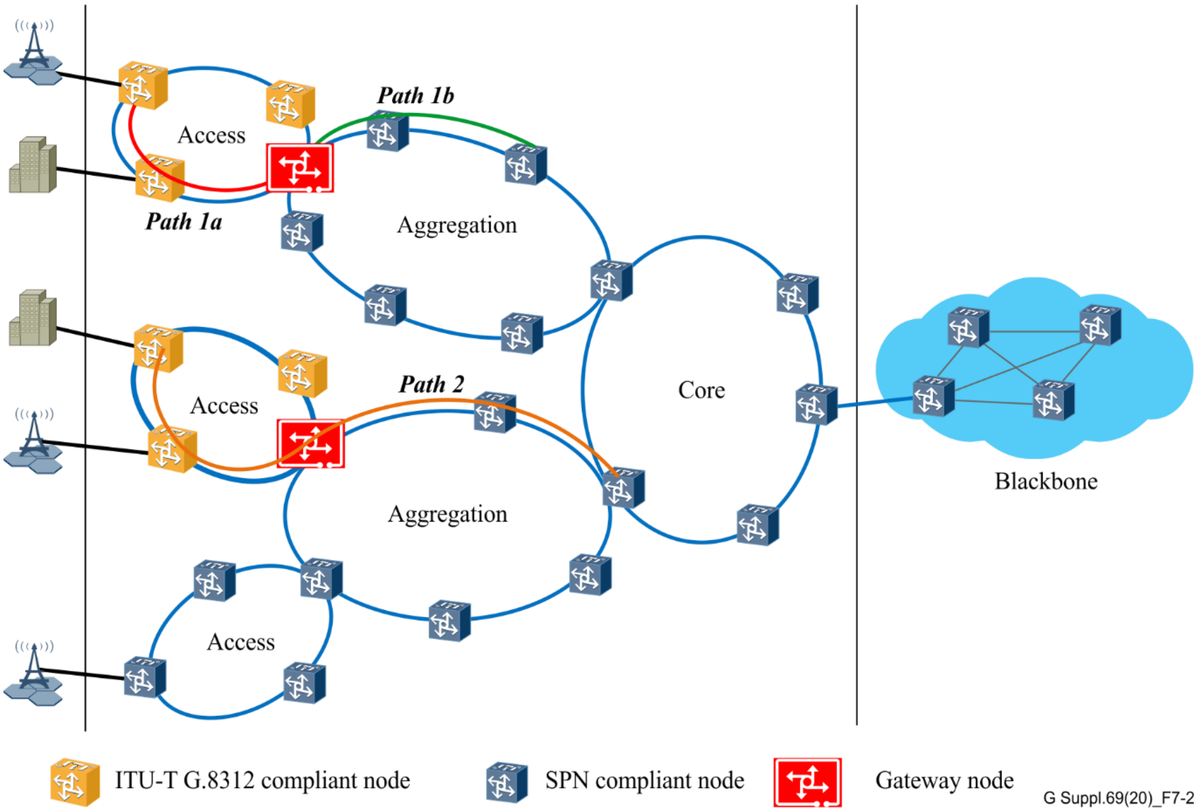

Figure 7-2 – Gateway node migration mode

8 General considerations

8.1 Differences between pre-standard and standard formats

During migration of a network from pre-standard OAM to MTN OAM, it is possible that a pre-standard path termination may be misconnected to an MTN path termination. Both the pre-standard and ITU-T G.8312 MTN path OAM use an IEEE 802.3 64B/66B 0x4B ordered set block type with a 0xC O-code. This ensures that intermediate nodes of either type are transparent to both path OAM protocols, and also ensures that edge nodes configured for either protocol will recognize that they are receiving path OAM information from the other edge node. However, the pre-standard path OAM uses a format that is distinct from the ITU-T G.8312 path OAM format. The differences in the format of the OAM block make it straightforward for a path termination point or node to determine if it is receiving the type of OAM it expects to receive. Detecting the mismatch through these criteria is explained in clause 8.2.

8.2 Detecting incompatible source and sink nodes for a path

The standard ITU-T G.8312 path OAM block format is shown in Figure 8-1 (see also Figure 8-7 of [ITU-T G.8312]). As illustrated in Figure 8-2, the pre-standard path OAM uses a proprietary block format that utilizes the last three bytes to carry information.

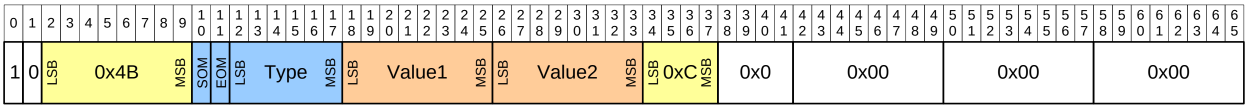

Figure 8-1 – General block format of ITU-T G.8312 path OAM

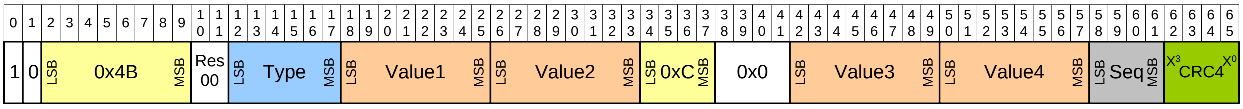

Figure 8-2 – General block format of pre-standard path OAM

The differences between the respective block formats allow a path sink node to identify the protocol used by the path source node. This identification does not require either a pre-standard sink or an MTN sink to understand the block definitions of the other protocol.

For example, an MTN sink can identify that it is receiving a pre-standard OAM block by examining the last 24 bits of the block. Since the pre-standard protocol uses a CRC-4 in the last four bits, the last three bytes will contain all-zeros in less than 1/16 (6%) of the received OAM blocks. Similarly, a pre-standard sink can identify that it is not connected to a pre-standard source due to having an incorrect value in approximately 15/16 of the received blocks. Thus, either type of sink node can identify whether it is receiving the expected protocol with >99% certainty after receiving two path OAM blocks. Additional fields in the path OAM block could also be used without the sink needing to understand how the other protocol uses those fields.

NOTE – A network element that can support both ITU-T G.8132 and pre-standard path OAM protocols may check additional fields beyond what is described in this Supplement to distinguish which OAM protocol is being received, since the Basic, auto protection switching (APS) and low-priority message formats are different.

The specific identification method is outside the scope of this Supplement.

9 Migration process

9.1 Initial configuration

At the start of migration, the network contains only pre-standard nodes.

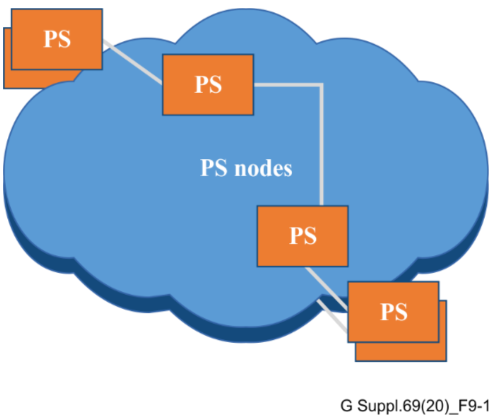

Figure 9-1 – Network configuration before migration

9.2 Early migration – introducing ITU-T G.8312-compliant nodes

As nodes supporting ITU-T G.8312-compliant OAM become available, they can be introduced into the network.

In the pass-through migration mode, a path that originates and terminates on new nodes can use the ITU-T G.8312 format. The pre-standard intermediate nodes do not process the path OAM, so they are not impacted by the edge nodes using ITU-T G.8312-compliant OAM.

In the gateway node migration mode, the migration process for this large-scale network is performed based on the geographic network deployment. In the early stage, a path can originate on a new node but terminates on a legacy pre-standard node, or vice versa. The gateway node is deployed on the boundary between the pre-standard SPN and MTN networks. See clause 7.2 for a description of the gateway migration mode.

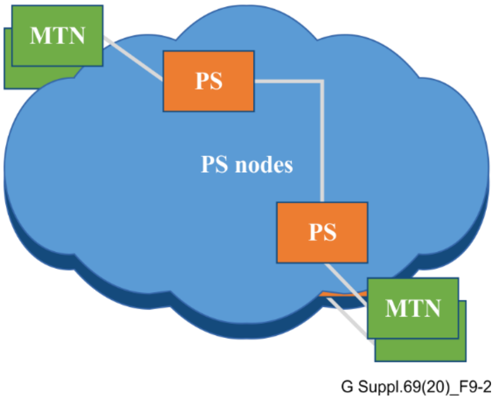

Figure 9-2 – Early-stage migration

9.3 Late migration – handling legacy pre-standard nodes

Over time, more standard-compliant nodes are added to the network.

In the pass-through migration mode, since an edge node may also be an intermediate node for other services, as the migration progresses the scenario may arise where some, or all, nodes between two pre-standard end point nodes have been upgraded, and there is a need for a path using the pre-standard OAM to be carried over new nodes. Again, since intermediate nodes do not process the path OAM, the ITU-T G.8312-compliant intermediate nodes are not impacted by the edge nodes using pre-standard path OAM.

In the gateway node migration mode, in the late migration process, most of the network areas are upgraded with the new ITU-T G.8312-compliant network nodes. A few network areas using pre-standard SPN OAM are sporadically located adjacent to the MTN networks. See clause 7.2 for a description of the gateway migration mode.

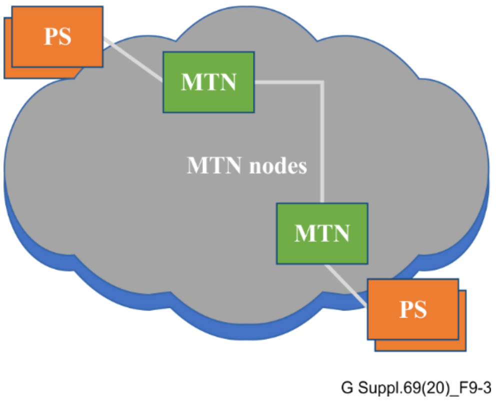

Figure 9-3 – Late-stage migration scenario

9.4 Final configuration

Eventually, the entire network has been upgraded to new nodes, and all paths are using standard-compliant OAM.

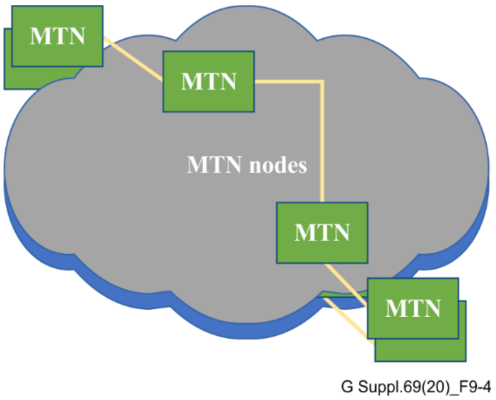

Figure 9-4 – Network configuration after migration

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[b-ITU-T G.8310] Recommendation ITU-T G.8310 (2020), *Architecture of the metro transport network*.

[b-CCSA-2019-1213T-YD] CCSA-2019-1213T-YD (2019), *General Technical Requirements for Slicing Packet Network（SPN）*.
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